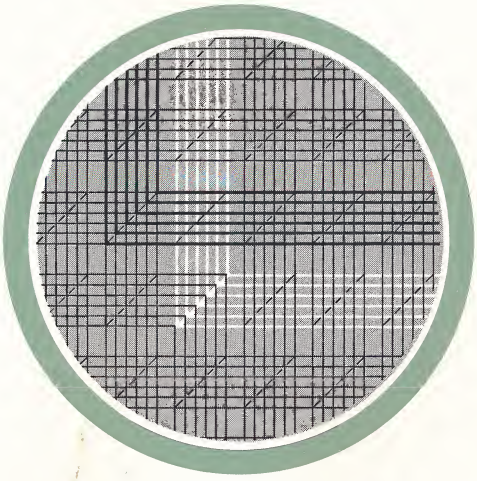
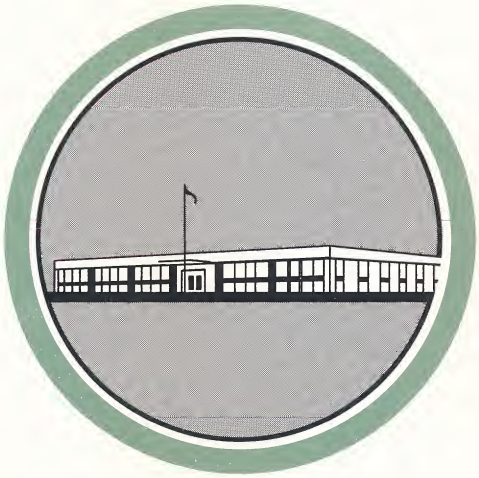
MANAGEMENT

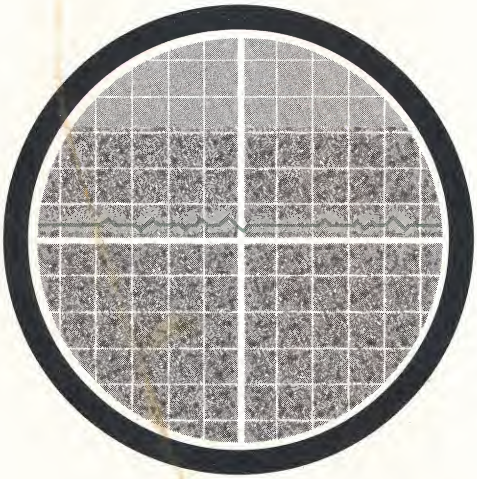


PRODUCTS

ENGINEERING



FACILITIES



QUALITY

Profile

Cunningham®

ESTABLISHED 1838

BULLETIN 65-110

OUR BACKGROUND

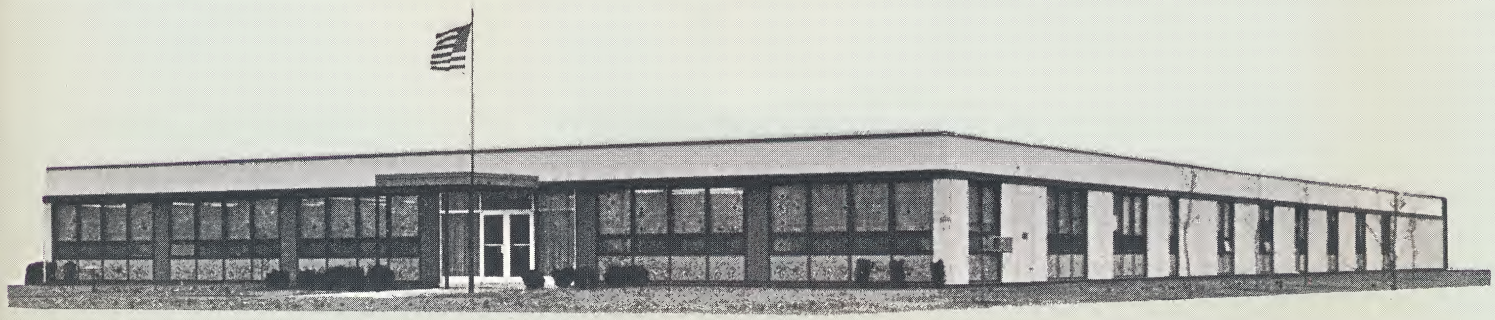
IF YOU HAVE participated in electronic system procurement and subcontracting, you know the importance of finding a source of the *right size* and the *right kind*. Cunningham is large enough, and well-enough equipped to perform, on schedule to exacting specifications, on any project we attempt; but equally important, Cunningham is *small* enough, and proud enough of its reputation, to care what happens to each and every customer.

SINCE 1838, the name Cunningham has been associated with high standards of quality, manufacturing skill, and integrity . . . regardless of the nature or application of the product. When you do business with us, you are dealing with a company that values its 127-year-old reputation far more than the profit or loss on any individual job, regardless of size.

Although our philosophies are traditional at Cunningham, everything else is as modern and forward-looking as the satellite and missile programs to which we devote so much of our energies. Our plant was built to the specifications of our production, product, and systems engineering departments. We believe it exemplifies the best in modern industrial architecture. In it, under one roof, are some of the most modern production, tooling, inspection, and development facilities in our field, together with an experienced engineering staff of exceptional competence and versatility.

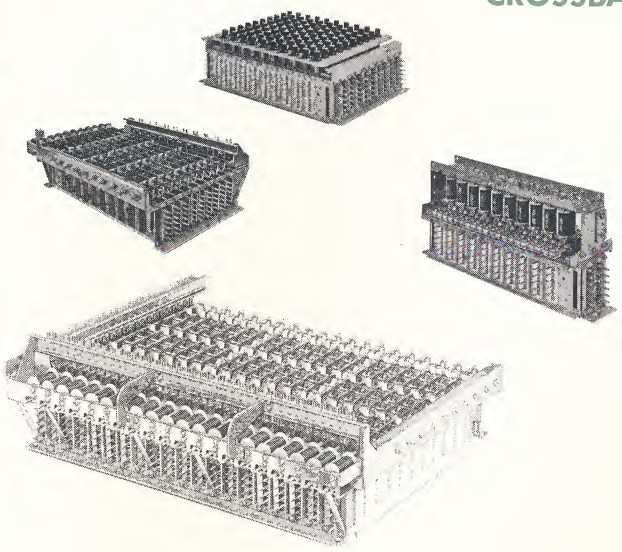
About our products: Cunningham crossbars are building our reputation all over the world. In the electronics industry, they are among the very few electromechanical devices that have been almost universally accepted as being distinctly superior to purely electronic alternatives. This is *not* true of other crossbars. No other crossbar is like ours, for our design is thoroughly patent-protected, here and abroad.

From this point of vantage—unique source for a distinctly different, distinctly superior switching device—we have progressed, over the past decade, to the development of electronic and electromechanical instruments, subsystems, and complete systems, for the manipulation of electrical signals, and of data in the form of electrical signals. There are hundreds of classes of electrical or electronic devices that use, in some form or other, Cunningham Crossbars, and Cunningham-designed control and logic circuitry.



OUR PRODUCTS

CROSSBARS

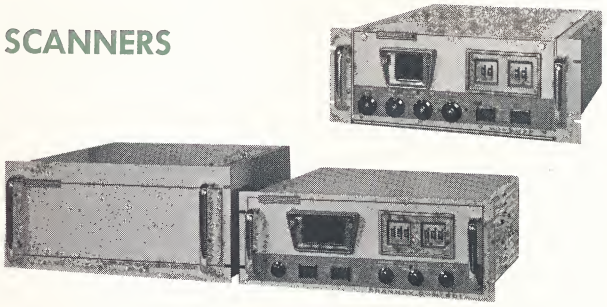


Field-attested reliability, operational flexibility, versatility — these characterize Cunningham Crossbars, which achieve nearly-ideal performance in routing, organizing and conditioning information in the most demanding low-level instrumentation, data acquisition, audio/video, pulse, logic and telecommunication applications. Crossbars have the highest contact density of any switching device. They operate with negligible crosstalk and distortion over a wide frequency range, with signal voltage levels from microvolts to 1,000 volts, and with signal current levels from a few microamps to 1 amp.

Cunningham Crossbars have a conservatively rated life of 20 million operations per crosspoint, without adjustment, an expected life of over 100 millions. They are available in a wide range of configurations and means of control. The two types of matrix configuration, the routing and the scanning, may be provided with one of three actuation means: coordinate electromagnetic, direct electromagnetic, or pushbutton operation. These six types of Crossbar are available in a number of switching capacities.

SCANNERS

The recently introduced Scannex series of solid-state controlled scanners provide a wide range of channel capacities for scanning, multiplexing, or sampling in data acquisition systems. Programming may be internally or externally controlled. Broad flexibility includes choice of sequences, first-to-last point selection, skip-scan, sync controlled scanning, random access to any point, and a variety of electrical and visual readouts. Scan rate is adjustable from ½ to 60 channels per second. Channel capacity ranges from 100 channels, or less, up to 10,000 channels.



HF SWITCHING SYSTEMS

Representing the most advanced developments in high-frequency switching, Cunningham HF Switching Systems, using Compensated Crossbars, provide complex signal-transfer functions from DC to 70 MC, without significant distortion or attenuation of the high-frequency components of the signal.

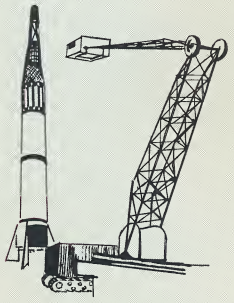
Their uses include complex video-signal switching, antenna multiplexing in complex communications systems, pulse-signal switching in radar computers and in navigational systems, signal scanning and synthesis in PCM telemetry, and format reorganization in high-speed digital-data processing equipment.

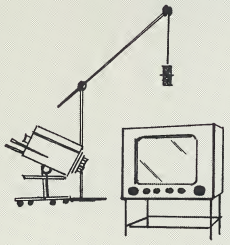
LOGIC/CONTROL SYSTEMS

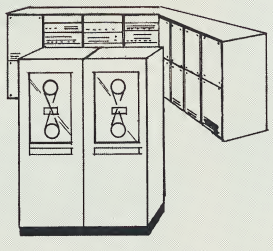
Because of their matrix format, inherent control simplicity, and electro-mechanical reliability, Cunningham Crossbar matrices bring to logic/control systems a high degree of command, control, and program flexibility and versatility. Because its operating rate exceeds that of the fastest tape-reader, card-punch, card-reader, or high-speed printer, the Crossbar has proven the most satisfactory, reliable and economic accessory for these devices.

Crossbar switching arrays can perform these functions: memory, random access, encoding, decoding, buffering, analog-to-digital, digital-to-analog conversions, program generation, self-clocked sequencing, and signal distribution (gating).

All of these functions are available in complete subsystem packages, examples of which are described on inside of back cover.







ENGINEERING

THE PLANNING BOARD *listens to a suggestion by its chairman, Peter Cunningham, President of the company.*

Engineering at Cunningham is divided into four discrete groups: Crossbar Engineering, Systems Engineering, Production Engineering, and Applications Engineering. Each group reports directly — and with equal voice — to management, which, in the form of a Planning Board, meets regularly and frequently to establish company policies and to direct the engineering effort *on a week-to-week basis.*

Therein lies our greatest strength . . . and the greatest advantage we bring to our customers. Everyone talks about flexibility, responsiveness, close engineering management of projects, etc. — we have made it come true, by building our organization in this unusual way.

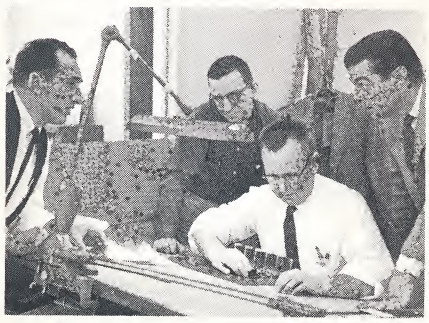
Another Innovation is our R & D plan — in which every one of the four engineering groups may independently sponsor an R & D project; may even carry it out with its own personnel, if it chooses. This encourages creativity from every man on the staff, on every facet of our products, all the time.

Finally, please note that we have recognized the basic differences between the conflicting attitudes of (and pressures on) the *designer*, the *builder*, and the *applier*, and we have given them equal voice and weight. This sensible plan makes our product better, our efficiency higher, and our service to you more complete and creative.

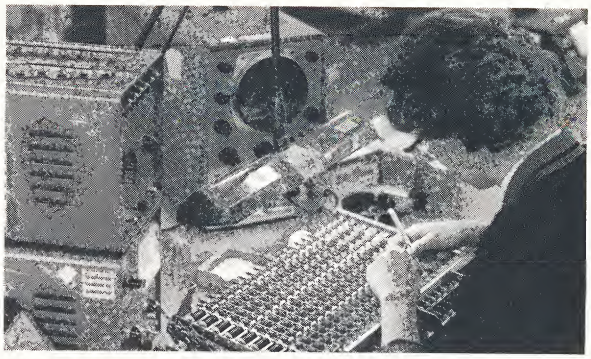
SYSTEMS ENGINEERING *is directed by Matthew Tubinis, who brings many years of high-level electronic-circuit design experience to the task. He directs a staff that includes Roger Haich, Sydney Chadwick, and Bob Margeson.*

Crossbar engineering, directed by Colin Ware, here benefits from the services of consultant Andrew Vincent, who brings years of experience as a crossbar design expert and holder of many basic patents in the field.

APPLICATIONS ENGINEERING *at Cunningham operates under the direction of Ned Wiseman, Director of Marketing and Sales. He works here with Howard Weissleader and Don Carpenter on a complex customer requirement.*



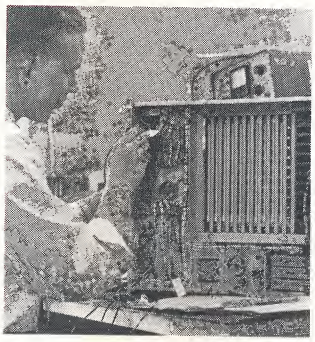
PRODUCTION ENGINEERING *is managed by Ernie Peters, who directs a technical staff of Ange Vasallo, Don Butler, and Wes Douglas. Every phase of product manufacturing is under their control.*

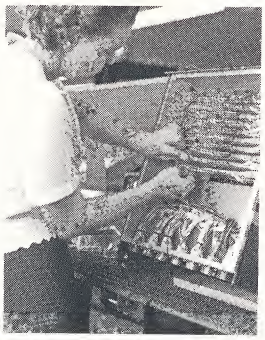


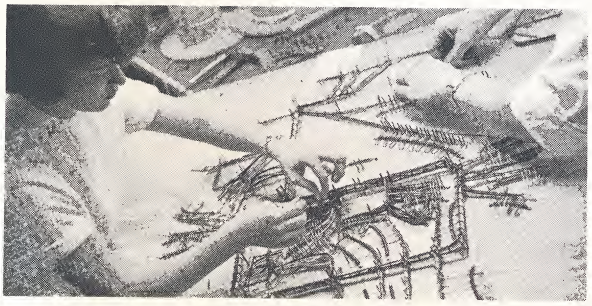
From the moment you approach our plant in its pleasantly rural setting of Honeoye Falls, to the moment you leave, you will be impressed with the fine balance we have struck between providing modern, attractive, stimulating surroundings, and maintaining economical, safe, productive simplicity. Colors are bright and varied, there is natural daylight everywhere, and everyone has room to breathe and work. On the other hand, we don't favor a lavish display — no "space-age" lobbies, no plush executive suites for us — just comfort, efficiency, and good sense.

We have devoted no end of care and concern to the selection and arrangements of machines and tools, instruments and work stations. A walk through our tool room, machine shop, and mechanical-assembly areas will demonstrate why a Cunningham Crossbar is rated at 20,000,000 operations/crosspoint.

Similarly, a tour through the electronic assembly and test facilities would show you why many of our customers have us wire up the entire crossbar subsystem — we are set up to conform to the wiring and assembly specifications of the fussiest MIL spec.







At every point in every process at which a test might uncover a significant weakness, you will find a test stand. Production at Cunningham is *tightly controlled.*

The office facilities here rival the manufacturing floor in logical, function-serving layout. Conference, laboratory, drafting, and thinking room is provided, where it's needed, and in good measure. This is a good place to work . . . an easy place in which to be efficient.

To match this plant growth, skilled quality conscious personnel have been added to the payroll from the high quality Rochester labor market and from precision industries throughout the country.

This orderly expansion of people and plant has ensured the maintenance of high quality standards and unmatched precision of Cunningham products.

Come and see us, if you have, or expect to have, dealings with us. Meet our people, inspect our facilities and our products. You are always welcome.

FACILITIES

LET US TELL YOU WHAT WE DO TO *ASSURE* THAT EVERY CUNNINGHAM PRODUCT IS AS NEAR PERFECTION AS WE (AND OUR CUSTOMERS) CAN AFFORD TO HAVE IT.

- Every Cunningham Crossbar element is designed so that the worst "algebraic sum" error pileup will not exceed required tolerances in any dimension or other parameter. No selection, fitting, or run-in is permitted.

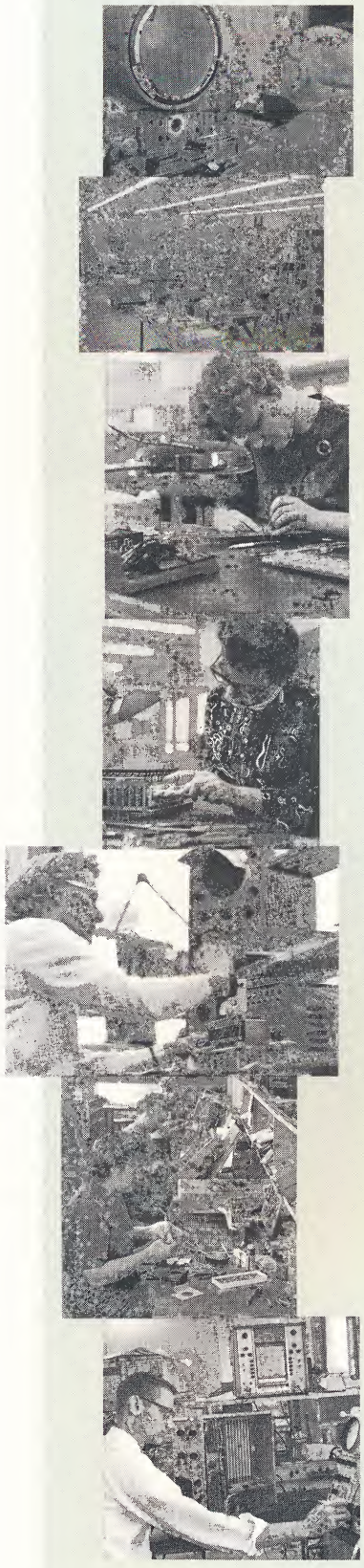
- Adjustments during manufacture are prescribed in type, technique, tooling, and degree.

- The entire production process has been broken down, by *function*, into units that are capable of self-checking their performance *within the unit*. Then, *every link* between units of production is broken by a QC station (see diagram).

- A *steady* reject rate greater than zero, however small, on any part, however minor its cost or function, is considered intolerable. It must be reduced to a random, insignificant, and occasional occurrence.

- Similarly, every wiring and assembly operation, every production technique, every circuit is subjected to the same requirement: random, accidental rejects only.

We are now equipped, in design and manufacturing techniques, to produce hundreds of circuits, assemblies, and complete subsystems with the same near-perfection as that with which we produce crossbars. Cunningham quality is yours on demand, from a crossbar to a complete automatic checkout console.



INCOMING MATERIALS

INCOMING COMPONENTS

TOOL PRODUCTION

COMPONENT PRODUCTION

CROSSBAR ASSEMBLY

CROSSBAR TEST

SHIP

INSTRUMENT & SYSTEMS ASSEMBLY

INSTRUMENTS & SYSTEMS TEST

SHIP

QUALITY ASSURANCE

Besides producing a standard line of electronic equipment — the Cunningham Crossbar switch and the Scannex — we also design and manufacture equipment for special applications, including custom and standard packaged switch modules and complete design and production of switching systems and subsystems. Those described here represent a cross-section of recently completed components and subsystems produced to exacting customer requirements.

CROSSBAR MODULE

In the first category mentioned, custom packaged units, is a completely enclosed, dust-proof, RF shielded Crossbar module which will be playing a critical role in life-support space missions. All control and signal circuits enter the module through connectors specially designed to maintain shielding.

Cunningham designed amplifiers on all inputs and outputs ensure balanced signals, at proper levels, through the switch. The design also incorporates a newly developed Cunningham latching actuator which maintains crosspoint closure magnetically, once the actuators have been energized by a momentary pulse. Release is made by application of a second pulse.

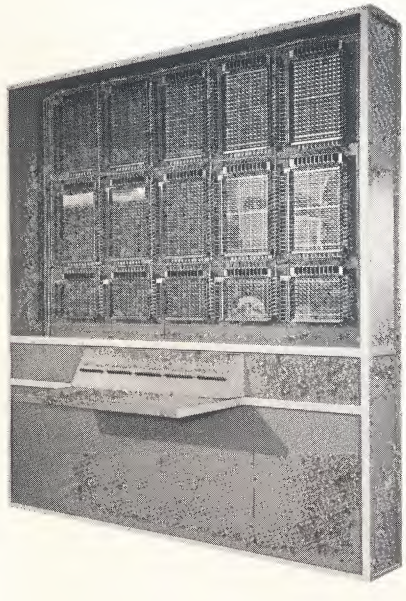
A primary concern of the customer was the need for complete reliability over a long operational life. The Cunningham Crossbar readily meets this requirement.

WIDE-BAND SWITCHING SYSTEM

A typical wide-band switching system is installed at NASA-Huntsville, capable of carrying the complete range of input signals from peripheral data-acquisition equipment, including analog, digital, voice and video. Frequency response of the switching system is +0.25, −0.05 db at frequencies to 50 kc; Crosstalk at 50 kc is −70 db; insertion loss is less than −0.1 db at 25 kc.

The switch matrix consists of Cunningham Type A Crossbar switches, including ten A20x10x6 and five A10x10x6 Crossbars arranged to provide 50 input and 50 output circuits, each with six levels.

Control is derived from a computer, which supplies information for selection of matrix crosspoints via a 16-bit register. Use of pushbuttons on manual-control panel bypasses computer control during test procedures.



Wide-Band Switching System

VIDEO SWITCHING

A 40-input, 10-output switching system handles composite video signals with crosstalk levels through the matrix better than −60 db at frequencies to 4.5 mc and roll-off attenuation of less than −0.1 db at 4.5 mc.

Control of the matrix, comprised of two Type A 20x10x6 Cunningham Crossbars, is from a control module located 50 feet from the video switches. Panel-mounted pushbuttons provide for selection of any input/output combination; active crosspoints are displayed numerically on the panel. Connections through the system are maintained until a release pushbutton is depressed. Pushbuttons are interlocked to prevent more than one input being connected to any given output, though up to ten simultaneous connections between ten different input/output pairs are possible.

Low crosstalk and attenuation are maintained by incorporation of stub-breaker switches (Cunningham Type P Crossbars) which apply a 124 Ω load on each idle output, and drop out the load when the output is switched into use.

Data Switcher

DATA SWITCHER

Used in the Down-Range Missile Tracking program, the manually-controlled switching system shown is one of four designed and built by Cunningham to switch data lines carrying signals of up to 300 kc. While the Wide-Band Switching System, described across the page, is expanded "horizontally" into a large matrix to provide input/output capacities beyond that of a single Crossbar, the Data Switcher matrix is expanded "vertically" to provide for more circuits per channel. Here, eight Cunningham Type A 20x10x6 Crossbars are stacked, with control wiring paralleled, resulting in a matrix with capacity of 10 inputs, 20 outputs, with up to 48 levels per circuit.

This system can readily be slaved to computer control. Digital compatibility and command flexibility give fast, uniform operation, suited to serial or parallel control by dial pulses, punched cards, or computer programmers. Matrix configuration facilitates either sequential access scanning or multiple connections, with immediate random access to any position without time loss or wear of intermediate points.

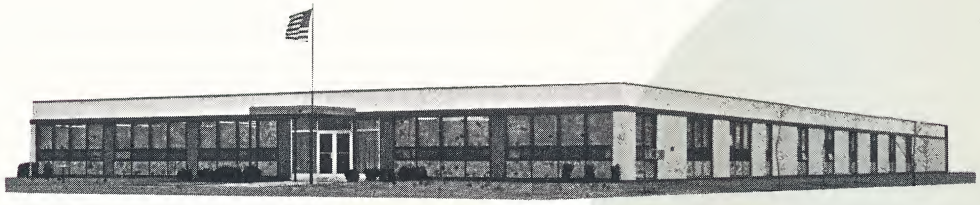
Cunningham's systems experience extends beyond the fields of data acquisition and video summarized above, to include applications in telemetry, audio, antenna, radar, component test equipment, and low-level instrumentation. In each case, our knowledgeability, coupled with the capabilities of the Cunningham Crossbar, has resulted in switching performance matching, and often surpassing, customer expectations.

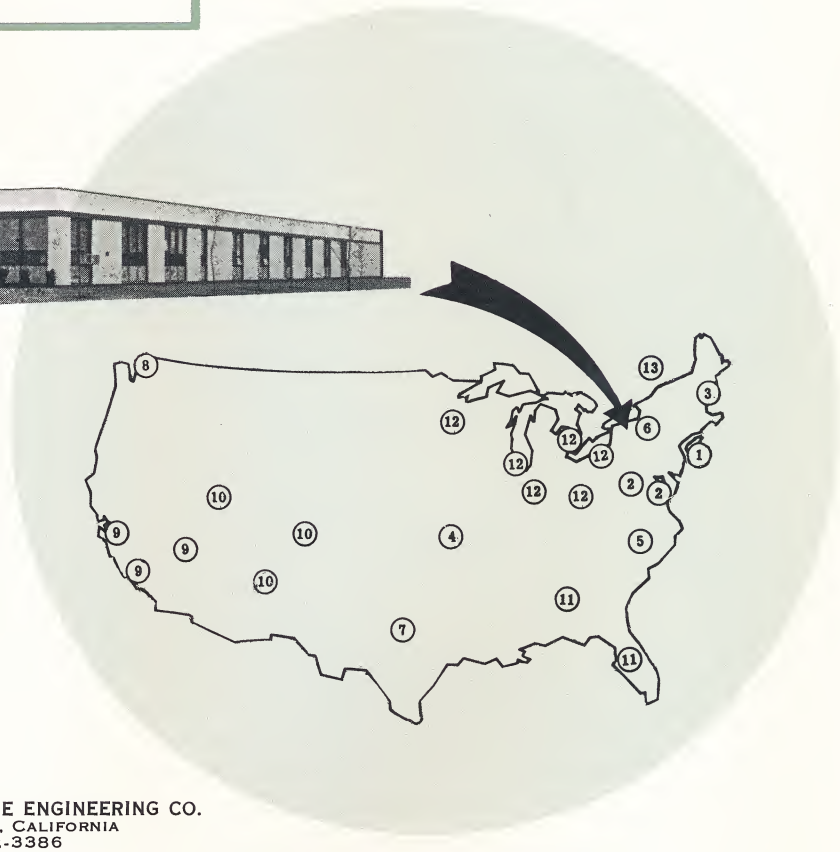
EXPERIENCE

CUNNINGHAM MANUFACTURER'S REPRESENTATIVES

Subcontracting systems activity is practical and efficient only if the liaison between the specifying group and the performing group is easily and economically maintained.

For this reason, Cunningham maintains a carefully-selected, periodically-retrained group of manufacturer's representatives operating out of offices in some 26 major industrial centers. These men are well qualified to function as intermediaries between our customers and our applications engineering group. They are fed a steady flow of pertinent information on our current engineering activities, and are visited by factory personnel several times a year.





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